

in form and more than usual correctness, and frequently in an unusual point of view. This is particularly noticeable in the chapters devoted to seismographs, which are refreshing in the absence of any polemical advocacy of one pattern of instrument or depreciation of another; there is little in the way of description of particular instruments or types of seismograph, and no attention is devoted to details of mechanical construction, which may vary according to the purpose of the instrument, but instead we have an impartial statement of the principles on which their construction is based and which control their action. The dynamics of the horizontal pendulum, which have been the subject of both mathematical and experimental investigation, are treated in a manner which makes them clear to anyone able to follow the simple mathematics used in the text, but it is unfortunate that Dr. Knott had not more mercy on those less mathematically disposed than himself, and expressed his numerical results in a form more immediately intelligible than that adopted by him.

This question of the behaviour of the horizontal pendulum in response to a periodic undulatory tilting, as opposed to its response to a static tilt, is one which has an important bearing on the design of seismographs; in most of these the design has been to eliminate resistance so far as possible, but there is another school which deliberately introduces a damping device of sufficient power to make the pendulum dead-beat or aperiodic, and it has been claimed that this damping renders the record accurate and capable of interpretation in terms of the displacement produced by a static tilt. Dr. Knott's figures show that this claim is unfounded. Where the period of the undulation is not less than three times that of the free swing of the pendulum, the amplitude of the record is within 10 per cent. of the displacement due to a static tilt of the same angle, the error being in excess in the case of the free and in defect in the case of the damped pendulum. When the period of the undulation approaches nearer to equality with that of the pendulum, the amplitude of the record increases largely in the case of the undamped pendulum and becomes diminished in the case of the damped pendulum, but in neither type is it possible to determine the true value of the angular tilt from the amplitude of the record. From this it will be seen that the result of a complete damping of the pendular swing is a diminution of sensitiveness of the instrument, and as it is only when the period of the undulation reaches three times that of the pendulum that either form gives a record capable of approximate interpretation in terms of the static tilt, there is no material difference in accuracy between the two when this limit is reached.

The periodicity of earthquakes is discussed at some length, with the general result that there is little evidence of the reality of any of the periods believed to have been established. We are not only in complete agreement with this conclusion, but would go even further than Dr. Knott in our distrust of the utility of applying the method of harmonic analysis to the discussion of effects the causes of which do not

vary in a harmonic manner, and the method seems particularly inapplicable to the discussion of the effect of tide-producing stresses in the causation of earthquakes. The amount and direction of this stress, at any given instant and place, depend on the zenith distance, not on the hour angle, of the tide-producing body, and though these vary with each other, they do not vary in any uniform proportion. In these circumstances an harmonic analysis of the time of occurrence of earthquakes seems calculated to obscure rather than elucidate any direct effect of the tide-producing force, though it might reveal a tidal effect of a different nature.

For the rest the book is an adequate and clearly expressed treatment of the subject it professes to deal with. It cannot be described as easy reading, yet the difficulty lies entirely in the accuracy of its expression, and the consequent necessity for the frequent use of words unfamiliar except to the trained physicist, but anyone who is desirous of understanding, and will take the trouble to master the meaning of these unfamiliar terms, will find no difficulty in following the argument.

METHODS OF ACCURATE CALORIMETRY.

Méthodes de Calorimétrie usitées au Laboratoire thermique de l'Université de Moscou. By Profs. W. Louguinine and A. Schukarew. Translated from the Russian by G. T. Gazarian. Pp. iii+192. (Paris: A. Hermann; Genève: Georg et Cie., 1908.) Price 8 francs.

THIS volume by the well-known director of the thermal laboratory at Moscow University and his chief of staff does not claim to be a comprehensive treatise on all branches of calorimetric work, but, nevertheless, it will be welcomed as placing before a wider public the results of much valuable research hitherto comparatively unknown, especially in detail. Some of Prof. Louguinine's ingenious devices for carrying out accurate calorimetric investigations have been partly described in specialist treatises, but we have here complete descriptions, with full and clear working drawings, published, we believe, for the first time, except in their original Russian.

In calorimetry, perhaps to a greater extent than in most branches of physics, very much of the success attained in a particular experiment depends on attention to what might be considered small details. In our opinion, one of the most valuable features of the book is the large number of "wrinkles" or "tips" given by the writers from their own experience on just those points on which the ordinary books are silent.

The first chapter is an excellent discussion of the various types of thermometers used in calorimetry. The writers point out the absurdity of adhering to the German form of thermometer with milk-glass scale, carrying the graduations behind a thin capillary tube and enclosed in an outer sheath. Even if the milk-glass scale is fastened more or less by fusion at one or the other end of the tube, the type has many drawbacks, and would probably have been replaced long

ago by the solid-stem type of thermometer had it not been for the fact that it is nearly impossible to make clear fine divisions on the kind of glass of which these thermometers are usually made. The sensitiveness, length of degree, size of bulb, &c., of thermometers for calorimetric purposes are dealt with in detail, the authors' conclusions being closely in accord with the recommendations of the Bureau International des Poids et Mesures.

The chapter dealing with the "cooling correction" is specially valuable, particularly the clearly described way of graphically applying the Regnault-Pfaundler method.

In the chapter on specific-heat determination, Prof. Louguine's tramway calorimeter is described. Details are given as to the curious fact, known to most who have worked at the subject, that it is extremely difficult in any form of vapour-heated vessel to arrange that the substance to be heated really reaches the temperature of the heating vapour employed, even if this be a vapour like steam, with a relatively enormous latent heat. A list of suitable substances for attaining various steady temperatures is also given.

An interesting chapter by Prof. Schukarew deals with some modifications of the Joly calorimeter, presenting some obvious advantages and giving increased precision.

In conclusion, we may say that the book is well got up, and the illustrations are numerous and excellent. A fault, however, is the large number of misprints and errata, many of which are not corrected in the list given at the end. It is startling to find many proper names, some those of leading authorities in the domain of heat—such as Bunsen, Velten, Callendar, Plattner, Wiedemann, Walferdin, Griffiths, and Dieterici—mis-spelt time after time.

J. A. HARKER.

TROPICAL AGRICULTURE.

Southern Agriculture. By F. S. Earle. Pp. vi+297. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1908.) Price 5s. net.

FOR many years there was a noteworthy dearth of books in English dealing generally with agricultural methods in the tropics and subtropics, and affording a concise summary of our knowledge of the plants of those regions. The information, it is true, was available in published form, but scattered in handbooks and pamphlets on particular plants and subjects, or buried in the files of numerous botanical and agricultural journals, so that those not actually engaged in the subject often found considerable and at times insuperable difficulties in obtaining a good, practical account of, for example, the principal fruits or the fibre-producing plants of warm countries.

To the still comparatively small series of books which supply such information, "*Southern Agriculture*," by F. S. Earle, is the latest addition. It does not profess to cover the whole range of tropical agriculture—which, indeed, would not be practicable in a volume of its size—but it so happens that the conditions in the southern States and the American possessions in the West Indies are so diverse, ranging

from normal and arid subtropical regions to the thoroughly tropical West Indian islands, that the book will prove of utility to a much wider circle than those immediately interested in the area with which it specifically deals. This is particularly marked in the first part of the book, entitled "General Considerations." Here Mr. Earle has given us the benefit of his experience in various lands, and in dealing, for instance, with such subjects as irrigation he brings out well the principles underlying practice in countries possessing very different conditions, explains how irrigation may be of value in humid as well as in dry countries, and gives useful descriptions of the methods in vogue in various districts. Other sections in this part which should be of wide interest are those relating to the improvement of the soil, marketing products, farm policy and management, and plant diseases. The division of plant diseases into three general groups—environmental, functional, and diseases due to parasites—and the clear discussion of the methods of dealing with each group will serve to illustrate the successful attempt to make the work more than a mere compilation of facts.

The second part, "*The Chief Southern Agricultural Crops*," is somewhat unequal in its treatment, but this is apparently in the main intentional, and is correlated with the relative local importance of the plants. Sugar-cane, the cereals, pasture and forage crops, tobacco, cotton, and, in particular, the fruits, are dealt with at considerable length, an account being given, not only of their botanical identity and mode of cultivation, but also of their principal pests, both insect and fungoid. Coffee and cacao are less fully treated, the large group of vegetables are disposed of in a few pages under the name of "*Truck Crops*," and a few notes on forestry and domestic animals conclude the volume.

The book contains the best account available, within small compass, of the agriculture of the warmer regions of North America and the West Indies, and, as already indicated, has in addition many features which will ensure it being of use also in other parts of the world.

W. G. FREEMAN.

ANALYTICAL CHEMISTRY.

Qualitative Analyse vom Standpunkte der Ionenlehre.

By Dr. Wilhelm Böttger. Second, revised and greatly enlarged edition. Pp. xvi+524. (Leipzig: Wilhelm Engelmann, 1908.) Price 10 marks.

IN the second edition of this book, which made its first appearance in 1902, the author has made very considerable additions, resulting in an approximate doubling of the original size. As the title indicates, it is written from the point of view of the theory of electrolytic dissociation. This fact, in itself, may be sufficient to condemn the book in the opinion of the chemists of the anti-ionic school, but there can be no doubt that the basis furnished by the ionic theory is the one which at present must be recognised as meeting with the approval of the great majority of scientific chemists.

The arrangement of the subject-matter is such that